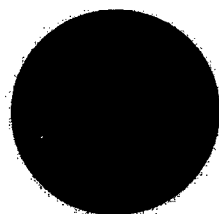


SULIT



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of
Computing

UNIVERSITI TEKNOLOGI MALAYSIA
FINAL EXAMINATION SEMESTER I, 2017 / 2018

SUBJECT CODE : **SCSJ 3553**
SUBJECT NAME : **ARTIFICIAL INTELLIGENCE**
SECTION : **ALL**
TIME : **9.00 AM – 12.00 NOON**
DATE/DAY : **13 / 01 / 2018 (SATURDAY)**
VENUES : **KTDI**

INSTRUCTIONS :

ANSWER ALL QUESTIONS IN THE ANSWER BOOKLET PROVIDED.

THIS TEST BOOK CONSISTS OF 3 SECTIONS :

SECTION A : TRUE / FALSE QUESTIONS [10 MARKS]
SECTION B : STRUCTURED QUESTIONS [20 MARKS]
SECTION C : APPLICATION QUESTIONS [70 MARKS]

(Please Write Your Lecture Name And Section In Your Answer Booklet)

Name	
I/C No.	
Year / Course	
Section	
Lecturer Name	

This questions paper consists of **ELEVEN (11)** printed pages excluding this page.

SECTION A – TRUE/FALSE QUESTIONS**[TOTAL 10 MARKS]****Instruction:**

This section consists of **TEN (10)** questions. Answer **ALL** questions. For each question, identify whether the statement in the question is **TRUE** or **FALSE**.

1. An admissible heuristic never reacts optimistically towards the cost to reach the goal.
2. The more informed an A* algorithm, the less of the space it needs to expand to get the optimal solution.
3. In Alpha-Beta pruning, the values of MIN are never decreased.
4. Pattern search algorithm is an example of recursive procedure with separation of knowledge and control.
5. One of the disadvantages of production system is modularity of production rules.
6. In an application of smart home, sensors are designed to respond to a set of limited inputs without ability to communicate between sensors.
7. Face and fingerprint identification applications are part of image processing and pattern recognition techniques.
8. Machine learning is a method designed to understand the behaviors of observed data based on training and testing of the developed algorithms.
9. In clustering methods, training dataset is used to categorize the characteristics or features.
10. Deep learning algorithm does not require feature extraction stage.

SECTION B – STRUCTURED QUESTIONS**[TOTAL 20 MARKS]****Instruction:**

This section consists of **FIVE (5)** questions. Answer all questions. Each question carries 4 marks.

1. Describe monotonicity in heuristics search. Support your answer with **TWO** examples.
2. Explain the production rules and working memory in production system. Give **ONE** example for each explanation.
3. Define the characteristics of social and autonomous in multi-agent intelligent systems. Provide **ONE** example for every characteristic.
4. What is the importance of rules within the multi-agent intelligent systems. Describe your answer with **TWO** case studies.
5. Explain **TWO** roles of feature extraction in machine learning.

SECTION C – APPLICATION QUESTIONS**[TOTAL 70 MARKS]****Instruction:**

This section consists of **SIX (6)** questions. Answer all questions. Each question does not necessarily carry the same marks. The marks is as indicated below each question.

Question 1 (Total 10 marks)

Consider the 3-puzzle problem, which is a simpler version of the 8-puzzle on a 2×2 board played with three tiles, numbered 1, 2, and 3, and one blank. There are four operators which can be used to move the blank tile **UP**, **DOWN**, **LEFT**, or **RIGHT**. The start and goal states are given in Figure 1 below. Using the best-first search technique, draw a heuristics search tree showing all possible paths leading to the goal configuration.

(10 marks)

Start		Goal	
2	3	1	2
1			3

Figure 1

Question 2 (Total 15 marks)

A search tree is given in Figure 2 below. Node **A** is the starting node and nodes **E** and **Q** are possible goal states. The value given to each node is the heuristic value of the node.

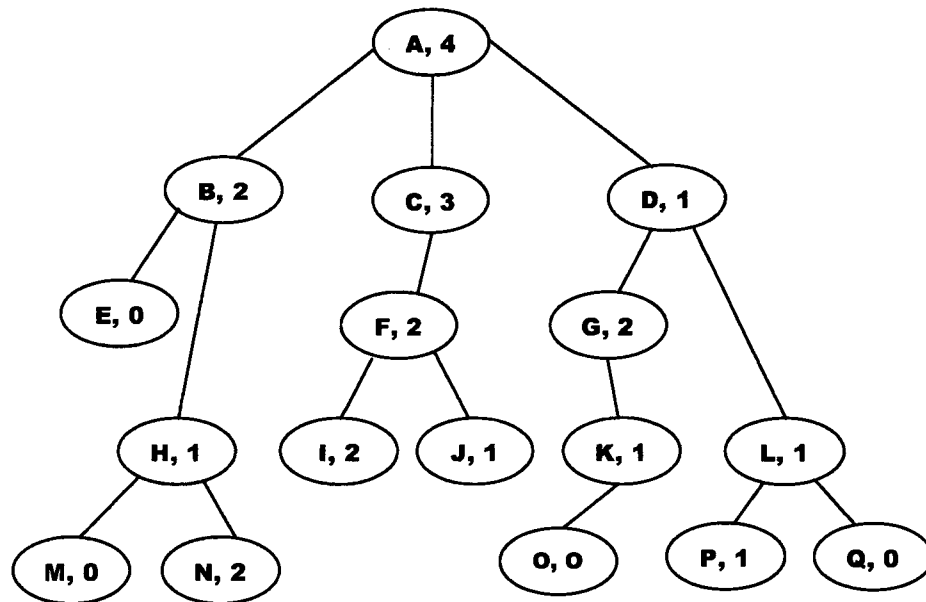


Figure 2

In implementing the search to reach the goal node, the evaluation function $f(n) = g(n) + h(n)$ is employed to decide the next best move to take where $g(n)$ is the depth of the tree and $h(n)$ is the heuristic value of that node.

- a) Calculate only the f values of each node (show all calculations) that are involved in the search. Table 1 shows all the nodes found in this tree.
 - i. Based on your calculations, circle the next best move to be taken at each level of the tree. Nodes that are not involved in the expansion will be left blank.
 - ii. Marks will be deducted if you attempt to evaluate these blank nodes.

(8 marks)

Table 1

n	f(n)	n	f(n)
A		J	
B		K	
C		L	
D		M	
E		N	
F		O	
G		P	
H		Q	
I			

- b) Indicate the best path to take from **A** to either one of the goal states (whichever is reached first by a better evaluation). (2 marks)
- Example : **A → E → Q**
- c) Describe how the next node to be expanded is chosen. (3 marks)

Question 3 (Total 14 marks)

- a) Assume that the board configuration in **Figure 3** is the present state in a game of tic-tac-toe.

o	o	x
x		o
		x

Figure 3

The next player to move is **X**. Identify which is the next best first move for **X** from the state in Figure 3. Using MINIMAX search, expand the game tree by generating all possible moves until the game ends (that is, either a winning state for **X** or **O**, or a draw whereby neither **X** nor **O** wins or loses). The heuristics to be applied is 1 (one) for win, -1 (negative one) for loss and 0 (zero) for draw (neither a win nor a loss for both **X** and **O**).

Assign either values at all leaf nodes and show all values to the current state. To help you get started, the next level of expansion showing **X**'s possible moves is given in **Figure 4** below.

Finally, indicate your answer by circling the board configuration of your choice for **X**'s next move. (9 marks)

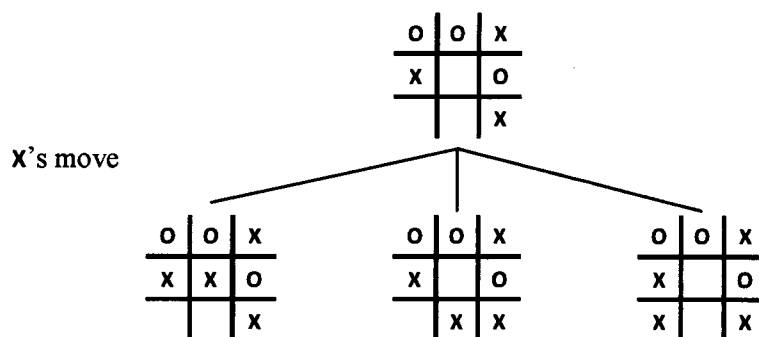


Figure 4

- b) Use the alpha beta pruning technique to search the following tree given in **Figure 5**. Show how values are assigned in all the nodes until it reaches the root node. Mark the pruned branches.

(5 marks)

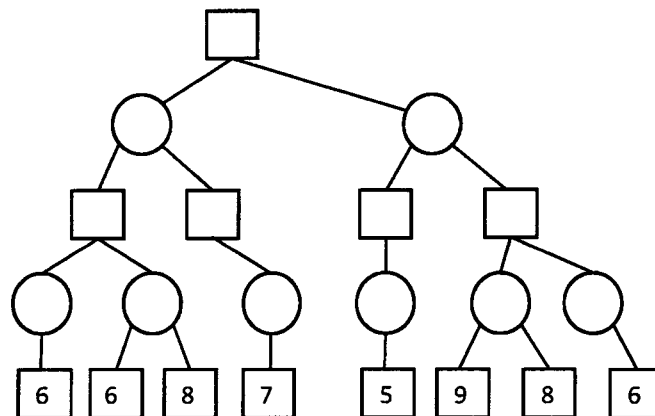
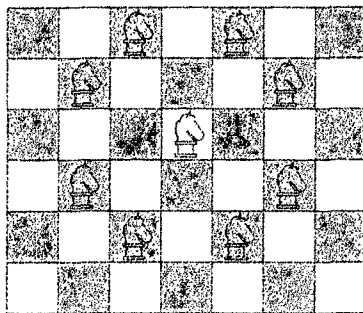


Figure 5

Question 4 (Total 8 marks)

- a) The configuration for a knight's tour problem on a 3 x 3 chessboard is given as in **Figure 6**. Develop a set of rules to represent the possibilities of movements for the knight on the given board. In a production system format indicate the necessary steps to move the knight from square 1 to square 9. Show your answer by filling up the necessary information in **Table 2**.

(8 marks)



1	2	3
4	5	6
7	8	9

Figure 6

Rules:

Table 2

Iteration	Working Memory		Conflict Set (Rule No)	Rule Fired
	Current Square	Goal		
0				
1				
2				
3				
4				

Question 5 (Total 18 marks)

- a) Represent your knowledge by assembling the partial description given about Multiple Intelligences below into a **STRUCTURED FRAME-BASED** representation.

Gardner (1983) introduced the Theory of Multiple Intelligences which meets with the criteria for a behavior to be intelligent. He believes that there are 8 types of intelligences: Spatial, Linguistic, Logical-mathematical, Bodily-kinesthetic, Musical, Interpersonal, Intrapersonal and Naturalistic.

Spatial intelligence deals with spatial judgment, and ability to visualize with the mind's eye. Potential careers for them are Architect, Artist, and *Engineer*.

Linguistic intelligence deals with spoken or written words. Potential careers for them are *Writer*, Lawyer and Teacher.

Logical-mathematical intelligence deals with logic, abstractions, reasoning and numbers. Potential careers for them are *Scientist*, Mathematician, Computer programmer, and *Engineer*.

Intrapersonal intelligence deals with introspective and self-reflective capacities. Potential careers for them are Philosopher, *Writer*, Theorist and *Scientist*.

Naturalistic intelligence deals with the ability to recognize and categorize plants, animals and other objects in nature. Potential careers for them are Farmers, Botanists and *Chef*.

(Note: The JOB frame will only cater for job titles that are in italics i.e. *Engineer*, *Writer*, *Scientist* and *Chef*.)

(10 marks)

- b) Given the diagram in **Figure 7** below. This diagram represents the architecture of a system in which the knowledge required for this system is to be collected from a specific environment by using an element(s) called sensor(s). The figure shows how the knowledge is represented and a searching mechanism is applied, which leads the solution to be delivered back to the environment through an actuator(s).

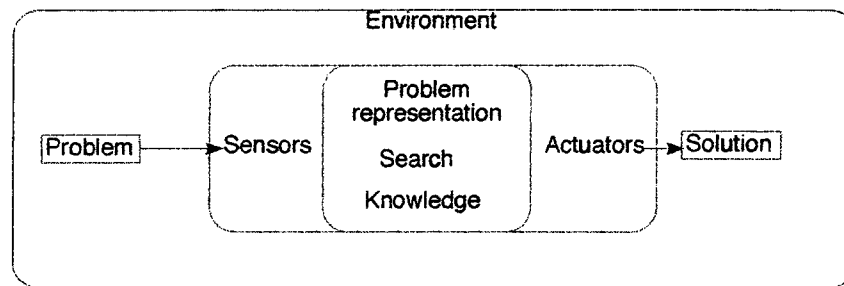


Figure 7

- i) What type of system the architecture in **Figure 7** represent of? Briefly explain **TWO** characteristics of this system.

(3 marks)

- ii) Give an example of application for this system. Describe how the characteristics mentioned in (i) fit in your chosen application.

(5 marks)

Question 6 (Total 7 marks)

For this question, you can choose to answer either part (a) **OR** part (b), but **NOT** both.

- a) Given Figure 8 as follows. Explain the machine learning technique concept and design an algorithm (in pseudocode form) that is able to perform the learning capability of the problem as depicted in the given figure.

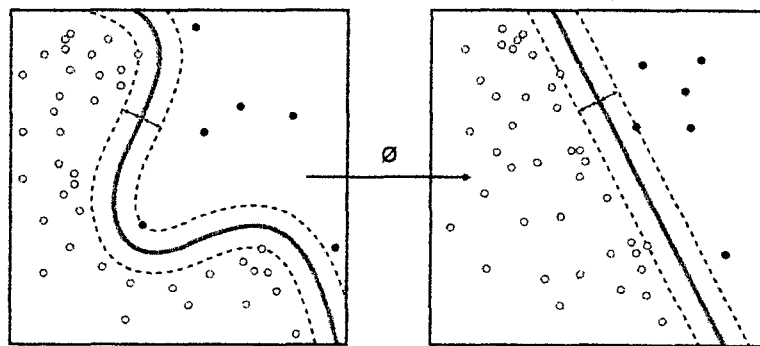


Figure 8

(7 marks)

- b) Consider a situation where you have thousands of news articles. You are given a task to categorize the articles according to their contents (Example: Economy, Sports, Entertainment, etc).
- i) Choose either **SUPERVISED** or **UNSUPERVISED** learning techniques to complete your task. Explain briefly how your technique works. (5 marks)
- ii) Based on the outcome of the application, suggest **ONE** other problem where you can use your chosen technique. Describe the expected output.

(2 marks)